THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION A—MATHEMATICS AND ASTRONOMY

As the American Mathematical Society held its annual meeting in affiliation with the American Association the special program of Section A did not include any technical mathematical papers. The most striking features of the program of this section were the joint sessions with Section B and the American Mathematical Society. The fact that such eminent men took part in these sessions enhanced the interest and called more general attention to the need of closer relations between scientific bodies representing neighboring subjects. In particular, the need of frequent conference between the physicists and the mathematicians can not be too strongly emphasized in the present stage of our development, and it is to be hoped that the eminently successful joint session of Sections A and B will tend to spread and intensify the appreciation of this need.

The address of the retiring vice-president, Professor C. J. Keyser, of Columbia University, was given during the joint session of Section A and the American Mathematical Society, held on Wednesday morning, December 29. During the same session Professor D. E. Smith, of Teachers College, Columbia University, read his paper on the work of the "International Commission on the Teaching of Mathematics." Professor Smith is chairman of the United States section of this important commission, the other members appointed by the central body are, Professor W. F. Osgood, of Harvard University, and Professor J. W. A. Young, of Chicago University. The paper by Professor C. Runge, Kaiser Wilhelm exchange professor of mathematics at Columbia University for the present academic year, was read at the joint session of Sections A and B and the American Mathematical Society, held on Tuesday afternoon. At the same session Professor E. W. Brown read his first paper.

An interesting feature of the program was the visit to Harvard College Observatory on Monday afternoon at the close of a brief session of the section. The director of the observatory, Professor E. C. Pickering, invited Sections A and E to visit the observatory at this time and he explained to them photographs and illustrations of work in progress. In view of the fact that Percival Lowell failed to reach Boston before the close of the program of Section A his paper was transferred to Section B. All the papers of the following list, with the exception of the five mentioned above, were read at the three special sessions of Section A. These special sessions were held on Monday afternoon, Tuesday morning and Wednesday afternoon. The complete list of papers accepted for the program of Section A is as follows:

1. "The Thesis of Modern Logistic" (vice-presidential address), by C. J. Keyser.
2. "On the Determination of Latitude and Longitude in a Balloon," by C. Runge.
3. "On Certain Physical Hypotheses sufficient to explain an Anomaly in the Moon's Motion," by E. W. Brown.
4. "The Work of the International Commission on the Teaching of Mathematics," by D. E. Smith.
5. "The Value of the Solar Constant of Radiation," by C. G. Abbot.
6. "A New Mode of Measuring the Intensities of Spectral Lines," by F. W. Very.
7. "The Absorption of Light by the Ether of Space," by F. W. Very.
8. "The Fireball of October 7, 1909," by F. W. Very.
9. "On a Recent Hypothesis and the Motion of the Perihelion of Mercury," by E. W. Brown.
10. "The Heliocentric Position of Certain Coronal Streams," by J. A. Miller and W. R. Marriott.
11. "The Mutual Relation of Magnifying Power, Illumination, Aperture and Definition in Telescopic Work," by David P. Todd.
12. "La Contribution Non-euclidienne à la Philosophie," by G. B. Halsted.
13. "Declination of the Moon for Greenwich Mean Time," by D. H. E. Wetherill.
14. "Meteorological Waves of Short Period and Allied Solar Phenomena," by H. W. Clough.
15. "Recent Work with the 6-inch Transit Circle of the United States Naval Observatory," by Milton Updegraff.
16. "The Canali Novæ of Mars," by Percival Lowell.
17. "Peculiar Star Spectra indicating Selective Absorption of Light in Space," by V. M. Slipher.
18. "Personality with the Transit Micrometer," by R. M. Stewart.
19. "Water Vapor on Mars," by Frank W. Very.
20. "The Existence of Anomalous Fluctuations in the Latitude as shown by Simultaneous Observations with the Zenith Telescope and the

Reflex Zenith Tube of the Flower Observatory," by C. L. Doolittle.

21. "Visual Observations of Variable Stars at the Harvard College Observatory," by Leon Campbell.

Professor Keyser's vice-presidential address appeared in full in the December 31 number of SCIENCE. In the absence of their respective authors the paper by Professor Todd and those of Messrs. Wetherill and Slipher were read by title, while that of Mr. Stewart was presented by Dr. O. J. Klotz, Ottawa, Canada. The abstracts which follow bear the same numbers as the corresponding titles in the preceding list.

2. The problem of finding your geographical position in a balloon from observations of the sun is very different from the same problem on board ship, for this reason, that in a balloon there is no dead reckoning. The method used on board ship of observing two altitudes of the sun at two different hours of the day can not be applied, for the two Sumner lines have to be shifted so as to correspond to the same moment and this can only be done by dead reckoning. In a balloon, therefore, the only way of getting your geographical position from the sun is by observing both altitude and azimuth at the same time. Now the accuracy with which the azimuth of the sun may be observed is rather small; it would be difficult to obtain it within less than one tenth of a degree. Therefore the reduction of the observations need not be very accurate, either. At the same time it is essential that the reduction should be made very quickly. For the time since the moment the observations were taken introduces an uncertainty that may be expressed by the area of a circle whose radius is equal to the distance through which the balloon may have traveled. One naturally would therefore turn to graphical methods for the reduction of the observations. The reduction consists in finding the latitude ϕ and the hour angle t from the declination δ, the azimuth a and the altitude h. Professor Runge proposes to find first the latitude ϕ from δ, a, h and then the hour angle t, from δ, a, ϕ. In both cases we have to deal with the representation of an equation between four variables. Both of these equations may be written in the following form:

$$f(p) + h(r, s)g(q) = k(r, s)$$

where p, q, r, s denote the four variables. That is to say, two of the variables enter the equations in functions of their own $f(p)$, $g(q)$ and the equation is linear in these functions, the coefficients being any functions of the other two variables. Equations of this kind may be represented graphically by the "méthode des points alignés" of Maurice d'Ocagne[1] taking $f(p)$ and $g(q)$ as line coordinates. I propose making $f(p)$ equal to the ordinate of the point of intersection of the straight line with the axis of ordinates and $g(q)$ equal to the gradient of the straight line, that is, the tangent of its angle with the axis of abscissa. In that way the rectangular coordinates of the point whose equation in line coordinates is the given equation, become:

$$x = h(r, s) \text{ and } y = k(r, s).$$

For any given value of p, the different values of q correspond to straight lines that form a pencil of rays, whose center is on the axis of ordinates at the particular value defined by p, and any alteration of p would simply shift the center along the axis without altering the pencil of rays in any other way. The whole diagram may therefore be obtained by drawing two figures, one containing the curves $r = \text{const}$ and $s = \text{const}$, the other containing the pencil of rays, and placing these two figures in the proper way, one over the other. It so happens in our cases that the variable p is the declination of the sun, which during the ascent of a balloon may be regarded as constant. The aeronaut would therefore merely use a definite superposition of the figures. They are photographed on transparent plates and a blue print is taken by copying the plates one after another on the same paper in the proper position. The aeronaut has one blue print to read off the latitude and a second one to read off the hour angle after he has found the latitude. The equations are:

(1) $\sin \delta + \cos \phi \cos h \cos a = \sin \phi \sin h$,
(2) $\tan \delta + \sec \phi \sin t \cot a = \tan \phi \cos t$.

In the first equation the curves $\phi = \text{const}$ and $h = \text{const}$ are the ellipses

$$x = \cos \phi \cos h, \qquad y = \sin \phi \sin h.$$

In the second equation the curves $\phi = \text{const}$ and $t = \text{const}$ are the confocal ellipses and hyperbolas

$$x = \sec \phi \sin t, \qquad y = \tan \phi \cos t.$$

3. Newcomb has shown that there is a difference between the observed and the theoretical positions of the moon which can be roughly represented by a term of period about 270 years and coefficient 13″. In this paper Professor Brown

[1] Maurice d'Ocagne, "Traité de Nomagraphie."

examined numerous hypotheses sufficient to explain the term, in order to clear the ground of those which seemed to be of doubtful value and to bring forward those which appeared sufficiently reasonable to merit tests from observations of a different nature. Some account of three of these hypotheses was presented to the meeting. It was stated that a minute libration of the moon would be sufficient, provided it took place in the moon's equator and had the proper period. The supposition of magnetic attraction practically demanded (*a*) a periodic change in the magnetic movement of the earth or of the moon. If (*a*) were rejected, it was necessary to suppose that the mean place of the lunar magnetic axis was near the lunar equator and that the oscillations of its position took place in the plane of the equator. The observed secular change of the earth's magnetic axis could not produce the phenomenon without demanding a larger motion of the lunar perigee than observation warrants. On the border line between two sets of hypotheses was a curious fact, namely, that if the period of the solar rotation coincided very nearly with one of the principal lunar periods a minute equatorial ellipticity of the sun's mass was sufficient to explain the term. So far as known, these hypotheses do not conflict with any observed phenomena but they cause some theoretical difficulties.

4. The International Commission on the Teaching of Mathematics was suggested some years ago, but the first steps in its organization were not taken until April, 1908. At that time the Fourth International Congress of Mathematicians, then in session in Rome, empowered Professor Klein, of Göttingen, Sir George Greenhill, of London, and Professor Fehr, of Geneva, to appoint such a commission, and to arrange for it to report at the next congress, to be held at Cambridge in 1912. As a result, three commissioners have been selected from each of the leading countries and the work has actively begun. It is expected that each of these countries will submit a very full report of the nature of the work in mathematics, from the kindergarten through the college, with some discussion of the range of advanced work in the universities. In the United States the investigation is carried on by means of fifteen committees, each divided into subcommittees. About two hundred and seventy-five people are engaged in the work and the subcommittee reports will be submitted during the present winter. The committee reports will be submitted before the summer of 1910, and the national report by Easter, 1911.

5. Since 1902 the staff of the Smithsonian Astrophysical Observatory has been engaged in bolometric measurements of solar radiation to determine the "solar constant," and to note possible variations of solar emission. The measurements have been conducted at Washington (sea level), at Mt. Wilson (one mile) and at Mt. Whitney (nearly three miles). When corrected for atmospheric losses by employing Bougner's transmission formula, and reduced to mean solar distance, the average results outside the atmosphere agree within 2 per cent. On good days at Mt. Wilson or Mt. Whitney the results have a probable error of about .5 per cent. By the construction and trial of three copies of a standard pyrheliometer of new design, in which the solar heating is continuously removed by water flowing about the walls of the hollow receiving chamber, and in which the accuracy of the measurements is checked by introducing known amounts of heat electrically in test experiments, the solar constant may now be expressed absolutely in calories per square centimeter per minute. Definitive reductions are not yet quite complete, but the final solar constant value will not differ 2 per cent. from 1.97 calories per square centimeter per minute. Variations of the solar emission of several per cent. from the mean value appear not to be uncommon, but during the continuance of the Mt. Wilson observations, prolonged periods of differences of 10 per cent. from the mean value, such as were suspected in 1903, have not been observed.

6. The method described by Professor Very consists in matching the two halves of a bright line, seen projected upon a uniformly illuminated background. One half of the line (it may be either the upper or the lower half at will) is a bright line or band in a photographic negative of a spectrum crossed by dark absorption lines, or in a positive of a bright-line spectrum. The other half of the line may be, if desired, a line in another spectrum, selected for its general similarity; but the best object for comparison is a slit over an illuminated ground-glass screen with means for the following adjustments: (1) The slit can be varied in width by a micrometer-screw. (2) The illumination of the ground glass can be varied by an optical device employing an iris-diaphragm. (3) The half of the field in which the image of the slit lies can be made to duplicate the other half by altering the illumination of the slit-jaws.

7. Professor Very believes that attempts to deduce a law of extinction of light in space, based

on the relative paucity of stars of the higher orders of magnitude, are probably illusory. The rate of extinction is small, and is marked by peculiarities of stellar distribution of a larger order. The evidence of a selective absorption or scattering of light, deduced by Kapteyn, appears to be real, but it is of local origin, and some new criterion is desirable.

An examination of the distribution, size and appearance of the nebulæ shows results which are in harmony with the supposition of an absorption of light by the ether of space. An attempt is made to deduce the distances of some of these objects; and the bearing on the problem of light-extinction furnished by such facts as can be learned from the nebulæ is discussed, together with the related questions of the knowable dimensions of the universe, and its coordination into a whole by means of a conservation of energy through ethereal and material interchange. The conclusion is reached that there is an absorption of radiation by the ether of space, and that a considerable fraction of the energy of the universe resides in the interstellar medium.

8. At $6^h\ 42^m$ in the evening citizens of Norwood, Mass., witnessed the fall of a brilliant orange-red fire ball which descended in a nearly vertical direction from an altitude of about 60° to the horizon, giving off laterally numerous white sparklets. The visible evidence of any explosions was lacking, and no sounds whatever accompanied the fall, which, according to the best observation, lasted about seven seconds. From internal evidence, it appears probable that the upper part of the path was seen almost end-on, and that the bolide may have reached the ground at no great distance. The claim that such was the case, and the asserted finding of a large and unique aerolite, were considered by Professor Very. Microscopic analysis shows that the stone is peculiar, and in spite of some doubtful points in the evidence, it is deemed best to put this evidence on record.

9. Professor Brown's second communication consists of a brief account of the hypotheses of Seeliger brought forward to account for the outstanding large residual in the motion of the perihelion of Mercury and the small residuals in the secular motions of the four minor planets. An analysis of the nature of the three hypotheses and a comparison of the number of arbitrary constants introduced with the number of residuals to be accounted for were also given.

10. Assuming that the theoretical corona is caused by light emitted by and reflected from streams of matter ejected from the sun by forces which in general act along lines normal to the sun's surface; that these streams are formed of a series of particles ejected from the same point of the sun's surface in such a way as to make a continuous stream, Professor Miller showed[2] that the curvature of these streams was due to mechanical causes, and that under certain conditions one could find the heliocentric position of these streams.

During the summer of 1909, Professor Miller examined and measured, at the suggestion of Director Campbell, the series of large-scale photographs of the solar corona made by him and other members of the staff of Lick Observatory, with a view of applying this theory to them. In all, there are sixteen streamers of this particular type recorded on these plates. Professors Miller and Marriott have since reduced the measures made during the summer. All the streamers measured have been reduced; there are two of them that can not be reduced according to this hypothesis. The others gave consistent and reasonable results. The purpose of the investigation was to locate, heliocentrically, these streamers. An interesting and striking by-product is, that under these hypotheses it is proved that these streamers can not assume the shape shown on the photographs unless they are acted upon, in addition to the attractive force of the sun, by a repulsive force of some kind, the magnitude of which can be determined.

11. Professor Todd's paper relates to experiments with the eighteen-inch Clark refractor at Amherst. They show the great improvement in definition of sun and moon, and the brighter planets and stars by simple reduction of the aperture to suit atmospheric conditions. Higher magnifying powers are thereby possible when the seeing is inferior, providing the illumination of the object allows. Variation of aperture from three to eighteen inches is effected by an iris diaphragm outside the objective.

12. This memoir gives the original meaning and the growth of meaning of non-Euclidean geometry, sketches its history and its founders, and points out that philosophy has found in non-Euclidean geometry a new criterion fusing into components of a new life the preexistent forms of Plato, forms of sensitivity of Kant, products of sensation of Locke, contributions of experience of Comte. Efficient science now finds trivial the old hypothesis of the importance of individual suffering, and the

[2] *Astrophysical Journal*, Vol. XXVII., No. 4.

new evasion that pain does not hurt—finds them as unnecessary as the parallel postulate.

13. For purposes of navigation, in checking the longitude, Mr. Wetherill proposes that the moon be observed in meridian altitude, and with the known latitude, the declination be interpolated in the "Nautical Almanac" for G. T. Where the change of declination is rapid per minute of time a good check can be made without the complication to the seaman of the calculation of the lunar distance.

14. Mr. Clough's study of meteorological and solar variations of short period discloses cyclical variations in the length of the period similar to those shown in 1904 to be characteristic of the 11-year and 36-year periods. The 3¼-year variation in the frequency of prominence and other solar phenomena, and the barometric pressure over Iceland and the Azores, ranges in length from about 2½ years in 1875 to 3¾ to 4 years in 1860 and 1893, showing a 36-year variation in the length of the period. The mean latitude of the entire spotted area is farthest north about eight months previous to the occurrence of a maximum phase of the pressure wave over Iceland. A 3-month period is shown to exist in spot and prominence frequency and also in the Iceland pressures, with variations in the length of the period conforming to variations in solar activity in the 3¼-year cycle, *i. e.*, the greater the activity the shorter the period. Two shorter periods of about 33 days and 10 days have been detected in meteorological phenomena, both of which undergo variations in length through a 3-month cycle.

The 3¼-year wave of pressure recedes from the Iceland Low to the Azores High in fourteen months, while the 3-month wave traverses the same distance in forty days. The 10-day wave, however, moves eastward around the globe, a continuous series of these waves having been traced over the United States during the past three years. This fact has an important bearing on recent measurements of the intensity of solar radiation at Washington and Mt. Wilson, the atmospheric transmissibility being apparently greater at the minimum phase of the 10-day temperature wave than at the opposite phase.

15. Professor Updegraff gave an account of the progress made during the past year in fundamental observations of the sun and fixed stars with the six-inch transit circle of the U. S. Naval Observatory in conformity with the plan for fundamental work adopted by the observatory council and approved by the superintendent.

The repairs made necessary by deterioration and the alterations of the instrument having been completed, the instrument was mounted in January, 1909, and observations of stars were commenced on January 31.

The form of the pivots and the stability of the rotation axis of the instrument have been thoroughly investigated and have been found to be highly satisfactory. The instrumental constants are remarkably stable and are determined with a satisfactory degree of accuracy, the probable error of a determination of the azimuth from the marks being $\pm 0^s.006$, of the level from the spirit level $\pm 0^s.006$ and of the collimation from the collimators, $\pm 0^s.006$.

The transit micrometer has been brought into use, and after practise the accidental errors of the observers are no larger than is the case with the chronograph key, which confirms the results reported by other observers using that form of instrument elsewhere in this country and in Europe.

The flexures of the telescope tube and the circles have been partially investigated and have been found to be small, the circles having no appreciable flexure. A preliminary investigation of the division errors of circle A has been completed and the results are being used in reducing observations in declination.

A series of observations by Mr. Hammond of stars direct and reflected has been reduced and a small difference reflected minus direct has been found which gives on discussion a value of the horizontal flexure the same as that obtained from observations on the collimators.

Satisfactory rates are given by the clocks in the clock vault. The clocks are not, however, in perfect order, as the bell jars leak somewhat, but all difficulties seem to have been overcome in regulating the temperature of the vault, which is kept constant within a few hundredths of a degree Centigrade for months at a time.

More than 3,500 observations of stars have been made in conformity with the plan for fundamental work mentioned above. The main features of this plan for fundamental work are as follows:

The clock rate is determined fundamentally by observation of the same clock stars by the same observer at consecutive transits.

The azimuth of the marks is determined by observations of circumpolar stars at consecutive transits U. C. and L. C.

The latitude for the reduction of observations

in declination is determined by observations of circumpolar stars at consecutive transits U. C. and L. C.

The sun and brighter stars are to be observed daily in both right ascension and declination, and the refraction by day and by night at all zenith distances is to be separately investigated and determined.

Systematic observations are being made in both right ascension and declination of lists about an hour long in right ascension of circumpolar stars, culminating between five and seven o'clock P.M. apparent local time, and of the same lists between the same hours in the morning at consecutive culminations as far as possible. These observations are made for fundamental places of the stars themselves and for the determination of the latitude and azimuth of the instrument and marks and of the atmospheric refraction. The advantages of observations of this kind are explained in SCIENCE, Vol. XXV., p. 689.

A group of nine fundamental stars near the vernal equinox has been selected for use as the fundamental standards in right ascension. They are being observed in connection with another group of stars near the autumnal equinox and are to be connected with stars at all right ascensions with a view to detect and determine systematic errors in right ascension. This requires the observation of stars more than twelve hours apart in right ascension on the same day by the same observer, and the work is combined with the observations of circumpolar stars described above.

16. On September 30, 1909, certain new canals were observed on Mars at the Lowell Observatory which proved to have an important history. The discovery of new canals on Mars, *i. e.*, some never before seen, is nothing new, as some four hundred have been detected there in the last fifteen years. The present canals were remarkable in being not only new to earth but new to Mars. This was proved by reference to the records kept of the observatory's observations since 1894. Not only had they never been recorded before, but examination showed that they were not due to any of the several causes which have been found there to affect the visibility of the canals, to wit: seasonal change, austral or boreal development, etc. They had therefore never existed previously but had just been formed. The importance of this discovery needs no comment, except that it was only made possible by the systematic, continuous research of fifteen years.

17. In the course of radial velocity work at Flagstaff, spectra of numerous stars in Scorpio, in Perseus and in Orion have been found to contain peculiarly sharp *H* and *K* calcium lines, which by their character and behavior seem to originate in inter-stellar space, according to Mr. Slipher.

18. At the Dominion Observatory, Ottawa, personal equation with the registering micrometer has been found to be not a negligible quantity. The paper by Mr. Stewart deals with the observations of 1908, giving the relative personal equations of the five observers engaged, and describing a short investigation into the causes underlying the phenomenon. In the case of the author there was found a tendency to set the movable wire always to the left of the star by a quantity in the neighborhood of a second of arc, depending on the magnitude; north stars at upper culmination would thus be observed too soon, others too late.

19. Apparent discrepancies in Professor Very's measures of the Lowell Observatory spectrograms of Mars and the moon, on which Professor Campbell has commented, are explained as due to the mode of reduction. In spite of minor variations, the mean readings for five plates gave for the extra intensification of little *a* in Mars in conventional units, a value nine times as great as the probable error. No greater accuracy than this is claimed, but the existence of water vapor in the atmosphere of Mars is believed to be demonstrated. The result is made possible by the superiority of Dr. Slipher's spectrograms.

Campbell's claim that Professor Very's result is due to a notable increase of *telluric* "*a*" which happened to coincide with the taking of the Mars spectrogram on *each* of five dates, is examined and rejected.

20. Simultaneous observations have been carried on with the two instruments mentioned in the title for the past five years; those for 1905–8 are available for this comparison, embracing 931 determinations. Confining our attention for the present to the larger deviations, we find the following results for the two instruments:

Both residuals 4 times the probable error, 2 (both like signs).

Both residuals 3 times the probable error, 9 (like signs, 8; unlike, 1).

Both residuals 2 times the probable error, 75 (like signs, 50; unlike, 25).

The preponderance of like signs seems to leave little doubt that anomalous fluctuations of very appreciable magnitude do occasionally take place.

21. Mr. Campbell gave a résumé of the visual

work on long-period variables begun at the observatory in 1889, when the list numbered seventeen stars, to the present time, when the list contains over three hundred; showing the progress that has been made in the methods of observing them.

The following members of Section A were elected as fellows: R. P. Baker, S. G. Barton, W. E. Brooke, Thos. Buck, Arthur Crathorne, R. T. Crawford, I. M. DeLong, C. E. Dimick, F. J. Dohmen, J. F. Downey, L. P. Eisenhart, J. C. Fields, B. F. Finkel, F. L. Griffin, A. G. Hall, C. N. Haskins, T. M. Holgate, J. I. Hutchinson, D. N. Lehmer, O. M. Leland, Wm. D. MacMillan, W. R. Marriott, C. N. Noble, J. A. Parkhurst, F. W. Reed, F. G. Reynolds, Charlotte A. Scott, A. W. Smith, R. M. Stewart, Joseph Swain. The section elected G. B. Halsted member of the council, E. R. Smith member of the sectional committee and H. W. Tyler member of the general committee. On recommendation of the sectional committee Professor E. H. Moore, Chicago University, was elected chairman of the section.

G. A. MILLER,
Secretary of Section A
UNIVERSITY OF ILLINOIS

SOCIETIES AND ACADEMIES

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON

THE 438th regular meeting of the society, held December 21, 1909, was devoted to a paper by Dr. I. M. Casanowicz on "The Alexander Legends in the Talmud and Midrash, with reference to Parallels in Greek and Assyrian Literature."

The passages in the rabbinical literature bearing on Alexander the Great may be divided into two sections: (1) those which refer to his relation to the Jews; (2) those which contain episodes of his expeditions and adventures.

The first part includes: (1) Alexander's meeting with the Jewish high priest. At the instigation of the Samaritans Alexander ordered the temple of Jerusalem to be destroyed; but being met by a procession of Jerusalem nobles, headed by the high priest, in whom he recognized the apparition which had walked before him in his victorious campaigns, he revoked the order and delivered the Samaritans into the power of the Jews. (2) The suits brought by several nations against the Jews before Alexander. The Canaanites brought action for the possession of the land of Canaan, as it admittedly was originally their fathers'. They were answered that as Canaan was the servant of Shem he and his possessions were the property of his master. The Egyptians claimed back the gold and silver of which the Israelites despoiled them at the exodus. They were met by the counter claim of the wages for the service of the Israelites for four hundred and thirty years.

The second part embraces the following episodes: (1) Alexander's dialogue with the sages of the South. He addressed to them ten questions on cosmogonic and moral subjects, as: What was created first? Who is to be called wise? Who strong? Who rich? etc. (2) Alexander's penetrating into the land of the Amazons. They ward off his attack by suggesting to him that there will be little glory for him if he killed them, being women, but that he will make himself eternally ridiculous should he be killed by them. (3) Alexander's visit to Qaçia. There he witnesses a suit before the king in which both litigants disclaim the ownership of a treasure. The king advises them to marry their children and give them the find. Alexander said he would have put the litigants to death and confiscated the treasure. The king of Qaçia declared that if rain falls and the sun shines in Alexander's country it must be on account of the animals, for the men did not deserve these boons. (4) Alexander's experience at the gates of Paradise. He was there refused admission but given as a token a ball. He weighed against it all his gold and silver, but could not counterbalance it. The rabbis put a little dust upon the ball and the scale in which it was immediately went up. They explained to him that it was the eyeball of a man who was never satisfied. (5) Alexander's ascent into the air. He rose up in the air until the world appeared to him like a bowl and the sea like a chalice. (6) Alexander's descent into the depth of the sea. He caused some of his men to dive into the ocean in glass chests. When returned to the surface they reported to have heard the ocean sing: "The Lord is mighty on high."

Most of these narratives are also found in the Greek compilation of the Alexander legends known by the name of Pseudo-Callisthenes, where they are embellished with many accessory details and otherwise much modified. The episodes of Alexander's adventure at the gates of Paradise or, as in the Greek account, the fountain of life, and his ascent into the air also suggest parallels in the Assyro-Babylonian literature; the first in the Nimrod Epic, the second in the Etana legends. There is a great resemblance between the rab-